

REMARKS

The non-withdrawn claims presently relate to a copper alloy for wiring and a semiconductor device.

Amendment Summary

Upon entry of this amendment, claims 7-25 will be pending in the application. Claims 7-16 have been withdrawn from consideration.

Claims 17-19 are amended to further specify the additional element. Support for this amendment is found in previous claim 20 and on at least page 24, lines 1-11 of the specification.

Claim 20 is canceled.

Claims 21 and 22 are amended by removing “Sn” from the elements listed in the claims. The listed elements in claims 21 and 22 now correspond to the claims upon which claims 21 and 22 depend.

No new matter has been added. Therefore, Applicant respectfully submits that entry of this Amendment is proper.

Claim Rejections

The Office Action mailed October 20, 2006 rejected claims 21 and 22 under 35 U.S.C. § 112 as allegedly being indefinite. Claims 17, 19, 20, and 23-25 were rejected under 35 U.S.C. § 102(e) as allegedly being anticipated by Andricacos. In addition, claims 18 and 22 were rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Andricacos in view

of Lee. Finally, claim 21 was rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Andricacos in view of Wang.

Response to rejection of claims 21 and 22 under § 112

Applicant respectfully requests reconsideration and withdrawal of this rejection.

The Office Action rejected claims 21 and 22 under 35 U.S.C. § 112 as allegedly being indefinite because of the use of the term, “and/or.” The Office Action stated that such a term rendered the claims unclear.

Applicant respectfully submits that claims 21 and 22 are clear and that the use of the term “and/or” does not render the claims unclear. With regard to the use of the term itself, Applicant’s representative has performed a search of issued patents, using the search engine provided on the USPTO’s website. Applicant’s representative has discovered that a search for patents with the phrase “and/or” in the claims (search term: aclm/("and/or"); database: full text patents 1976-present; search performed on November 19, 2006) returned 128,709 patents. Therefore, Applicant respectfully submits that the phrase, “and/or” does not, by itself, render the present claims unclear.

In addition, Applicant notes that the Office Action correctly understood the meaning of the claim (see the last full paragraph on page 2 of the Office Action).

In view of the above, Applicant respectfully submits that claims 21 and 22 are not indefinite. Reconsideration and withdrawal of this § 112 rejection are respectfully requested.

***Response to rejection of claims 17, 19, 20, and 23-25 under 35 U.S.C. § 102(e) based
on Andricacos***

Applicant respectfully requests reconsideration and withdrawal of this rejection.

The present claims relate to a copper alloy for wiring composed of a polycrystalline copper alloy containing Cu (copper) as a primary element and an additional element. Independent claims 17 and 19, upon which claims 20, and 23-25 ultimately depend, further specify that the additional element is at least one element selected from a group consisting of Ti (titanium), Zr (zirconium), Hf (hafnium), Cr (chromium), Co (cobalt), Al (aluminum), Ni (nickel), Mg (magnesium), and Ag (silver).

The Office Action rejected the above claims based upon the teachings of Andricacos. However, Andricacos teaches a copper alloy that includes at least one alloying element selected from the group of indium, tin, and carbon (see column 5, lines 30-33). Andricacos also does not teach the use of other alloying elements.

Applicant respectfully submits that Andricacos does not anticipate or render obvious claims 17, 19, 20, and 23-25 because it does not show the use of any of the currently claimed additional elements. Andricacos is silent regarding the use of Ti (titanium), Zr (zirconium), Hf (hafnium), Cr (chromium), Co (cobalt), Al (aluminum), Ni (nickel), Mg (magnesium), or Ag (silver) in its copper alloy, which are required by the current claims. Therefore, Applicant respectfully requests reconsideration and withdrawal of this § 102 rejection.

In addition to the above, Applicant also notes that Andricacos does not explicitly show the concentrations of claims 24 and 25. Applicant presently claims a concentration of the

additional element at the grain boundaries and in the vicinities of grain boundaries on the order of 2-1000 times (claim 24), and more specifically 10-100 times (claim 25) the additional element concentration at the inside of the crystal grains. The Office Action cites Andricacos' teaching that the concentration of the additional element at the grain boundaries and in the vicinities of grain boundaries may be at least 120% of the additional element concentration at the inside of the crystal grains. However, Applicant respectfully submits that such a teaching does not anticipate the 1,000% to 10,000% range required by claim 25 or the 200% to 100,000% range required by claim 24 (claims converted to percentages here for ease of comparison only). For these additional reasons, Applicant respectfully submits that Andricacos does not anticipate or render obvious claims 24-25.

*Response to rejection of claims 18 and 22 under 35 U.S.C. § 103(a) based on
Andricacos in view of Lee*

Applicant respectfully requests reconsideration and withdrawal of this rejection.

With regard to independent claim 18, it recites a copper alloy for wiring composed of a polycrystalline copper alloy containing Cu (copper) as a primary element and an additional element. Claim 18 also requires the additional element to be at least one element selected from a group consisting of Ti (titanium), Zr (zirconium), Hf (hafnium), Cr (chromium), Co (cobalt), Al (aluminum), Sn (tin), Ni (nickel), Mg (magnesium), and Ag (silver). In addition, claim 18 requires that an oxide of the additional element be formed at said grain boundaries and/or in vicinities of said grain boundaries.

Andricacos, which teaches copper alloys, is discussed above.

Lee is directed toward aluminum and aluminum alloy precipitates used in semiconductor applications. The Office Action cites Lee for the teaching that it is desirable to form an oxide on the surface of a diffusion barrier layer and in the grain boundary thereof for the purpose of improving the effectiveness of the diffusion barrier. However, there is no reference to copper or copper alloys being suitable for use in the disclosure of Lee.

Applicant respectfully submits that the combined teachings of Andricacos and Lee do not render claims 18 and 22 obvious. As an initial matter, Applicant respectfully submits that Lee does not fix the deficiencies of Andricacos that are discussed above.

Additionally, Applicant respectfully submits that there is no motivation to combine Lee with the teachings of Andricacos. Lee expressly teaches the use of aluminum or aluminum alloys in its disclosure, whereas Andricacos is expressly concerned with the use of copper alloys. There is no indication within Lee or within Andricacos that the oxide taught by Lee would be useful in copper alloy applications or even that such an oxide could be successfully used. Hence, one of ordinary skill in the art would not be motivated to apply the oxide teaching in Lee to the copper alloy taught by Andricacos.

Even if there were motivation to combine these references, which there is not, Applicant respectfully submits that such a combination would not render claim 22 obvious. For the reasons already cited, Andricacos does not anticipate nor render obvious claim 19, upon which claim 22 depends. Because the teachings of Lee do not fix the deficiencies of Andricacos with respect to

claim 19, Applicant respectfully submits that the combination of these references cannot render claim 22 obvious, either.

In view of the above, Applicant respectfully requests reconsideration and withdrawal of this rejection.

Response to rejection of claim 21 under 35 U.S.C. § 103(a) based on Andricacos in view of Wang

Applicant respectfully requests reconsideration and withdrawal of this rejection. Claim 21 depends from claim 19. As argued above, claim 19 is not anticipated by or rendered obvious by Andricacos. The Office Action cites Wang for its teaching of the use of intermetallic compounds of tin and copper. Applicant notes that claim 21 does not include a recitation of a tin compound. In addition, Wang does not remedy the deficiencies within Andricacos, cited above. Therefore, Applicant respectfully submits that the combined teachings of Andricacos and Wang do not render claim 21 obvious.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

AMENDMENT UNDER 37 C.F.R. § 1.111
Appln. No. 10/538,306

Atty. Docket No. Q88465

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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